Thermo
ELECTRON CORPORATION

C3i Multifunction
Centrifuges

SERVICE MANUAL
89003535

CAREFULLY READ THIS MANUAL AND THE OPERATING MANUAL BEFORE REPAIRING YOUR INSTRUMENT

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c	March 2006	5 28-32	Addition of service contact information Modification of spare part list
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1 INTRODUCTION

1.1 Purpose

This manual contains maintenance instructions for C3i Multifunction centrifuge and is intended for use by a qualified maintenance or service technician (We suggest reading also respective Operating Manual).
It is organised to provide maintenance personnel (Thermo or authorised service organisation) with basic data and information on the theory of operation to assist in troubleshooting, it outlines parts replacement and calibration procedures for putting the centrifuges back into service.
Should a specific maintenance problem arise which is not covered in this manual, please ask the authorised service organisation, or contact our division indicated here below.

Concerned units:

11175770	Centrifuge C3i Multifunction	230V 50/60Hz
11175771	Centrifuge C3i Multifunction	120V 60Hz
11175773	Centrifuge C3i Multifunction	100V 50/60Hz

However it is always possible to have copies, updated or revisions of this manual contacting our division:

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2 BIOLOGICAL RISK

Most of the safety problems related to appliance maintenance are due to human errors caused by tiredness, lack of attention, negligence, incompetence, and more frequently than you might think, as a consequence of extreme “familiarity” with biological risk; attitudes which bring to underestimate the risk of exposure to pathogens.
It is not possible to carry out effective techniques of biological risk containment without taking into account previous attitude of final user. Any prevention and biological risk containment program has to be based on correct **information** and **training** aimed to make all people concerned adopt **ways of acting** so that risk of auto-contamination and contamination of working area is reduced to the minimum.

Potential exposed people directly or no directly concerned in lab activities are usually researchers, lab technicians, but also cleaning staff, maintenance personnel, no-technical personnel (employees, storekeepers, drivers, caretakers, etc.), occasional visitors (agents, visitors, etc.) and, in case of accidents or disasters, rescue service (firemen, stretcher-bearers, doctors, policemen, civil defence, etc.).

Technical, organisational and procedural measures for biological risk containment, according to Art. 79 of D.L. 626/94, must include:
Evaluation of the danger level and quantity of biological material handled,
A careful planning of working process to reduce or avoid the use of harmful pathogens and to reduce the number of exposed people,
The choice of technical measures of protection, collective and individual, as well as hygienic ones to prevent an accidental spreading of biological agents out of working place,
Arrangement of suitable procedures and systems for conservation, handling, collecting, and transporting inside and outside working place, safe discharge of biological material used and periodic check of an eventual presence of pathogens inside working place.

To satisfy partly requirements mentioned before, Thermo established **a Declaration of Decontamination**, which must be filled in by final user before sending the centrifuge to a Technical Assistance Centre. The principle that inspires this declaration is awareness that user only knows what has been put into the centrifuge, and who handles these substances only is able to choose and use suitable product for decontamination.

Obviously, this assumption of responsibility by final user does not relieve maintenance personnel of adopting protection measures against residual **risk** eventually occurring when handling a product that conditions of use are unknown. Anyway, residual risk can be further reduced by means of **Individual Protection Devices**: gloves (lattice made, not yet used), masks, safe glasses.

3 DESCRIPTION AND THEORY OF OPERATION

3.1 Description

The C3i centrifuge is designed to separate substances made of different density elements by Relative Centrifugal Force (RCF).
Different rotating equipment can be used in order to match the sample containers and the required performances.
The maximum speed and by consequence the resultant RCF is a function of the rotor in use, swing-out rotor can usually carry an higher load than fixed angle or aerodynamic rotors which can spin at higher speed.
For more information on operating principle refer to the User's Manual.

3.2 Specification

		Dimensions
Height	H	37,5 cm
Width	W	40 cm
Depth	D	48 cm
Packaging	H x W x D	48 x 54 x 61 cm
		Weight
Net weight		40 kg
Net weight including packaging		45 kg
		Centrifugation characteristics
Max allowable capacity:		
swing-out		4 x 280 ml
fixed-angle		6 x 94 ml
Max allowable density		1200 kg/ m^3
Max allowable weight		1.34 kg
Max speed:		
swing-out		4100 rpm
fixed-angle		14600 rpm
Max RCF at Tip:		
swing-out		3176 x g
fixed-angle		23113 x g
Working temperature		Ta + ΔT
Max noise		< 63 dBA
		Electrical characteristics
Operating voltage:		230 V~ ±10% 50/60 Hz 120 V~ ±10% 60 Hz 100 V~ ±10% 50/60 Hz
Operating current		$I_{(steady)}$ $I_{(acceleration)}$ V_{Mains} 2,8 A_{rms} 5,5 A_{rms} 230 V 4,3 A_{rms} 9,5 A_{rms} 120 V 4,9 A_{rms} 10,5 A_{rms} 100 V
Power max (steady)		350 W
Power max (acceleration)		1000 W
Heat dissipation		1195 BTU/h

Other Characteristics

- Microprocessor controlled
- 5 quick selection programs
- RCF control
- Work temperature Tambient + ΔT
- Set/reading speed: 500 - 14600 rpm (10 - 100 rpm incr.)
- Acceleration profiles (5 shapes selectable)
- Deceleration profiles (4 shapes + 1 free coasting) selectable
- Set timer from 0.30 min up to 99 min + ∞
- Pulse key "Momentary Spin"
- Electronic (accelerometer) imbalance detector
- Three Phase Induction Motor
- Direct drive

3.3 Installation precautions

The centrifuge is designed to be safe under the following conditions:

- Indoor use
- Altitude up to 2000m
- Temperature: from 5°C to 40°C
- Maximum relative humidity 80% (for temperature up to 31 °C)
- Mains supply voltage fluctuation up to ± 10% of the nominal voltage

⚠ ***Incorrect installation will affect safety and equipment performances***.

The machine must be installed in a dust and non corrosive environment.

1. The Bench top must be rigid, sufficiently strong and levelled.
2. 300 mm of free space gap must be left on each side of the machine, behind to ensure the proper ventilation.

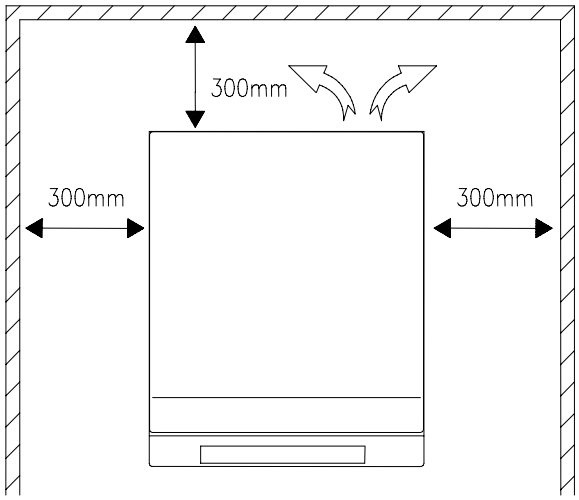


Fig. 1

⚠ **The centrifuge could move as a result of rotor imbalance, rotor disruption or drive failure. To avoid dangerous consequences a safety envelope clearance around the unit must be respected.**

3.4 Component layout

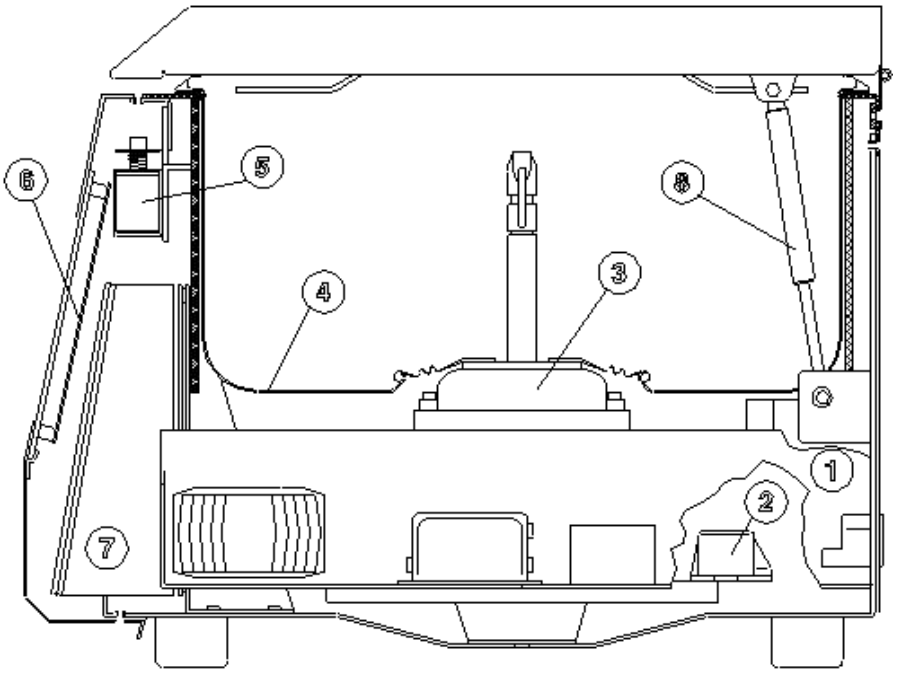


Fig. 2

① Inlet appliance
② Imbalance sensor
③ Asynchronous motor
④ Centrifugation chamber
⑤ Lid lock solenoid
⑥ Display assembly + keyboard
⑦ μP +PWR board
⑧ Gas spring

3.5 Mains front-end rack

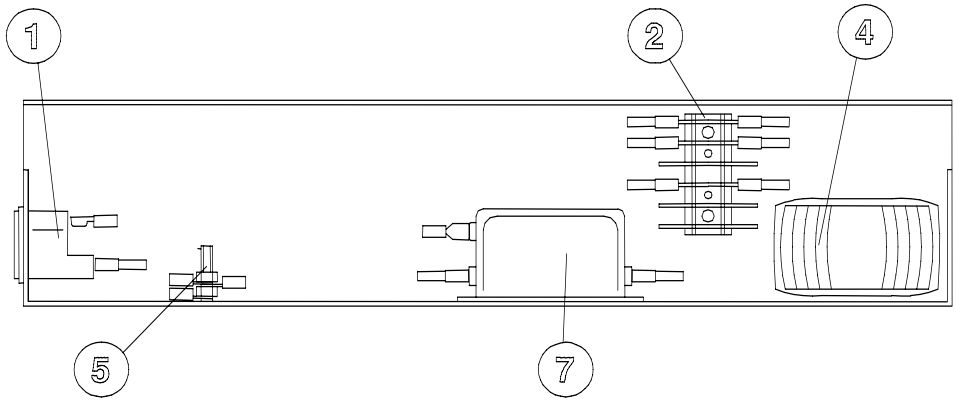


Fig. 3

① Appliance inlet and fuses holder
② Terminal block Fast-on
④ Mains transformer
⑤ Protective conductor terminal
⑦ Mains filter

3.6 Functional principles

The microprocessor system controlling the C3i centrifuge ensures the following functions :

Operator interface management
The operator interface, composed of a LED display and a keyboard, enables programming of the centrifugation parameters and visualisation of operating conditions in real time

Rotation speed servo-control management
From a tachometer signal, the microprocessor calculates in real time the controls to be applied to the power components to perform as programmed :

- rotor type identification (maximum speed restriction)
- acceleration and braking profiles
- rotating speed/g-force
- time

Management of the safety devices
The control system manages all the safety devices:

- lid locking system
- imbalance detection system
- zero speed detection system
- motor over-temperature detection system
- over-speed control

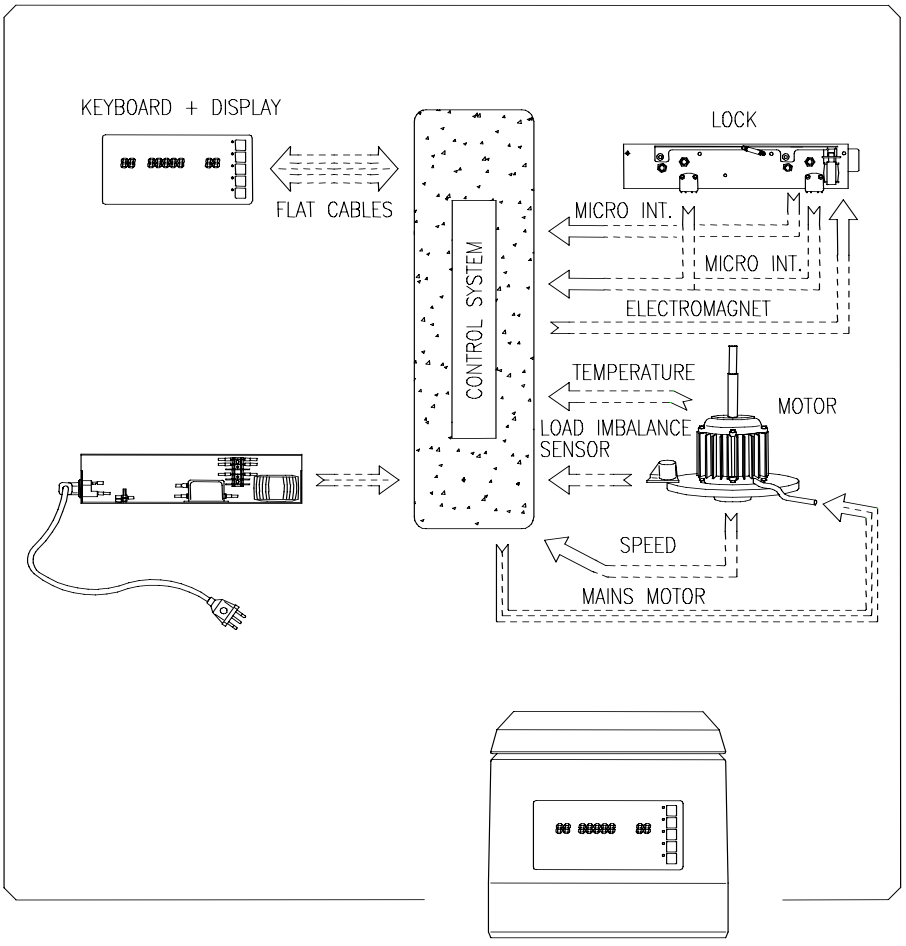


Fig. 4

3.7 Management of the induction motor

3.7.1 Introduction

The C3i centrifuge is equipped with an asynchronous 3 phase induction motor.
During operation, the control electronics generates a system of sinusoidal 3 phase voltages, variable in amplitude and frequency.
During the braking phase, the energy generated by the motor is dissipated through a resistor.

3.7.2 The motor

It is an AC Induction Motor, called squirrel cage motor, is comprised of a simple cage-like rotor and a stator containing three windings. The changing field produced by the AC line current in the stator induces a current in the rotor which interacts with the field and causes the rotor to rotate. No brushes are necessary in this design. The base speed of the AC motor is determined by the number of poles built into the stator windings and the frequency of the AC input voltage. Variable speed control of an AC motor can be accomplished by increasing or decreasing the input frequency. A load on the motor causes the motor to "slip" in proportion to the load.

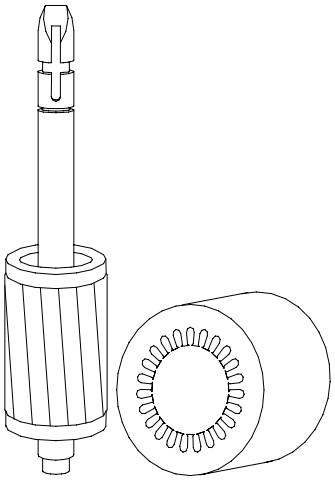


Fig. 5

3.7.3 Power control operating principle

It consist in a single phase rectifier (in case of 100/120V is used in the voltage doubler configuration) which converts the AC single phase source in a DC supply. Electrolytic capacitors are used to provide energy storage for the DC supply
A three phase inverter consisting of six IGBT is used to drive the motor.
Three phase AC is then generated by using sine wave pulse with modulation. The microprocessor controls the voltages and frequency of the AC output supplied to the motor.
Because AC motor under sine wave excitation are also capable of generating a dynamic brake is used. When the speed command is reduced in an AC drive, the motor will regenerate. The real part of the three phase power flows from the motor to the inverter. This results in current flowing from the inverter into the DC bus capacitors. Because this energy cannot flow back into the AC supply it must be stored in the capacitors or dissipated through a brake resistor if the voltage will rise over the defined safety level.

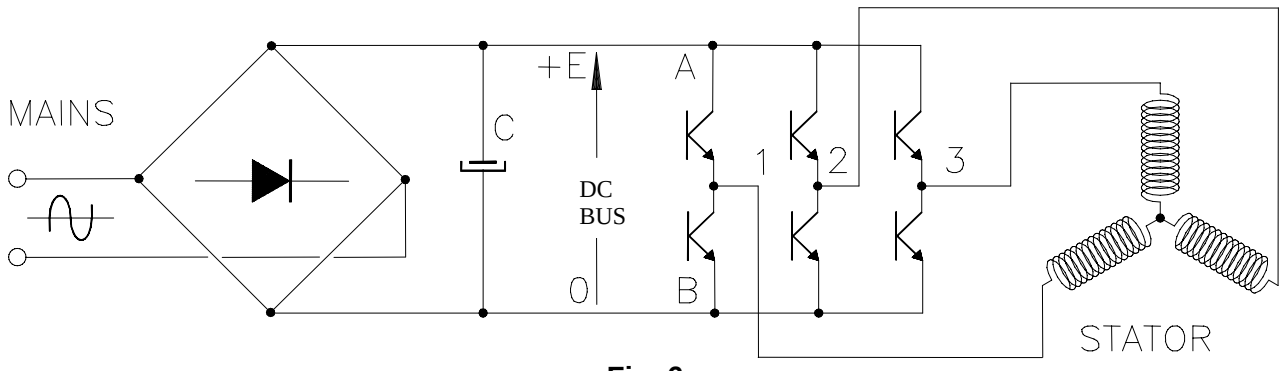


Fig. 6

3.8 Electronics

3.8.1 Generality

Electronic consist in two boards:

- μP + PWR board (equipped with 16bit micro-controller) located behind the front panel (see Fig.2, n.⑦).
  The centrifuge management program is stored "EPROM" memory, configuration data are stored in non-volatile "RAM".
- User interface (display and a keyboard) attached directly on the rear of the front panel (see fig. Fig. 2.⑥).

The imbalance sensor is fixed on motor counterweight trough elastic suspension (see Fig. 2, number ②); it detects motor vibrations (usually caused by improper rotor load).

3.8.2 Differences between models (230V-120V-100V)

The main difference between 230V and 120V is on the input stage of the motor power control. As mentioned in par. 3.7.3 the single phase rectifier, in case of 100/120V, is used in the voltage doubler configuration. The bridge rectifier is onboard for the 230V version, located on the electronic rack (see par.5.10 - ④) for the 120V. So two different μP + PWR boards are used. The 100V is derived from a 120V using at step-up transformer located inside the centrifuge. Wiring connection are reported in Appendix 1 (par 9)

3.8.3 Micro Processor + PWR board

3 distinct areas can be identified on this board. Each of the 3 areas has its own power supply. Insulation between the different parts is ensured by the use of opto-couplers. (Fig.7).

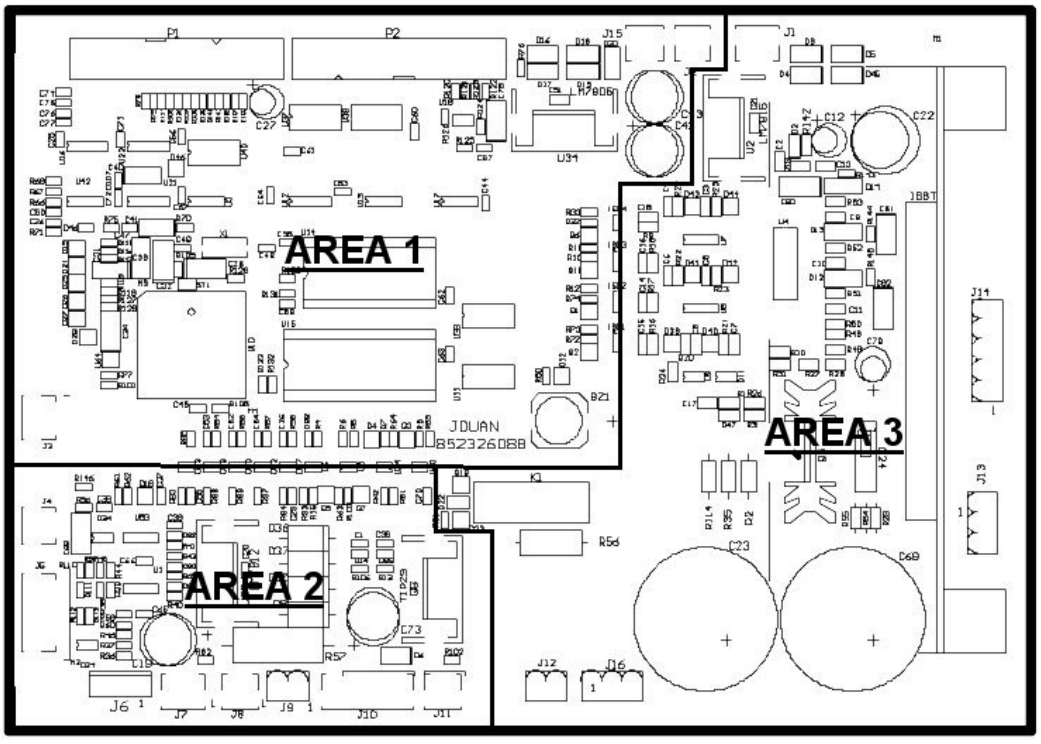


Fig. 7

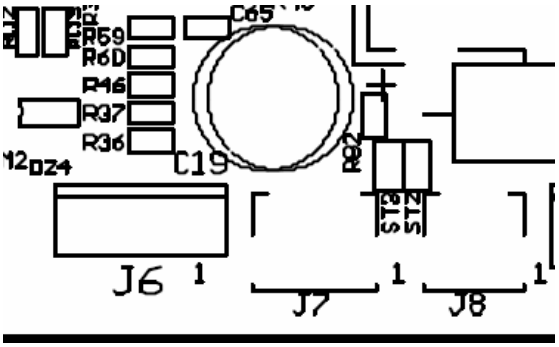
AREA 1
It includes the microprocessor, the EPROM, the RAM memory and the backup battery
The power supply for this part of circuits is 5 $V_{DC.}$

AREA 2
It consist in sensors interface and signal conditioning circuits, including the Opto-couplers which improve the level of noise immunity
The power supply for this part of circuits is 12 $V_{DC.}$

Note: In case of replacement of MOTOR or μP+PWR it is mandatory to have the proper jumpers configuration

The motor with magnetic speed sensor REQUIRES

Jumper ST2 = Closed (short circuit)
Jumper ST3 = Open



AREA 3

CAUTION : RISK OF ELECTRIC SHOCK **!**

Includes all the power circuits and it is directly connected to the mains.
Main function are:
- DC bus (320 $Volt_{DC}$) , the incoming AC power is rectified and filtered to supply the 3 phases motor inverter
- The optical insulation (barrier which provides protection against electric shock) between life parts and microprocessor circuits
- Three phase inverter consisting of six IGBT (one package module) and his control logic circuit.
- Motor brake (IGBT).

3.8.4 Imbalance detector

The imbalance sensor detects the mechanical vibration of the motor which are converted in electric signal managed by the microprocessor.
In case of anomalous vibration the run is aborted.
Imbalance sensor connector (J4 μP + PWR board) :
pin 1: Power Supply +12V
pin 2: GND
pin 3: SIGNAL

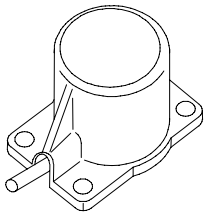


Fig. 8

3.8.5 Speed sensor

It is a magnetic encoder system based on aluminium disk holding two magnets and an Hall-effect sensor underneath (see Fig. 13).

Magnetic sensor connector (J7 μP + PWR board) :
pin 1: GND
pin 2: SIGNAL
pin 3: Power Supply +12V (selected by Jumper ST2)
pin 4: Not used

Optical sensor connector (J7 μP + PWR board) :
pin 1: GND_{SIGNAL}
pin 2: SIGNAL
pin 3: GND_{Vcc} (selected by Jumper ST3)
pin 4: Photo-diode Supply

3.8.6 Inputs – Outputs connection

230V version

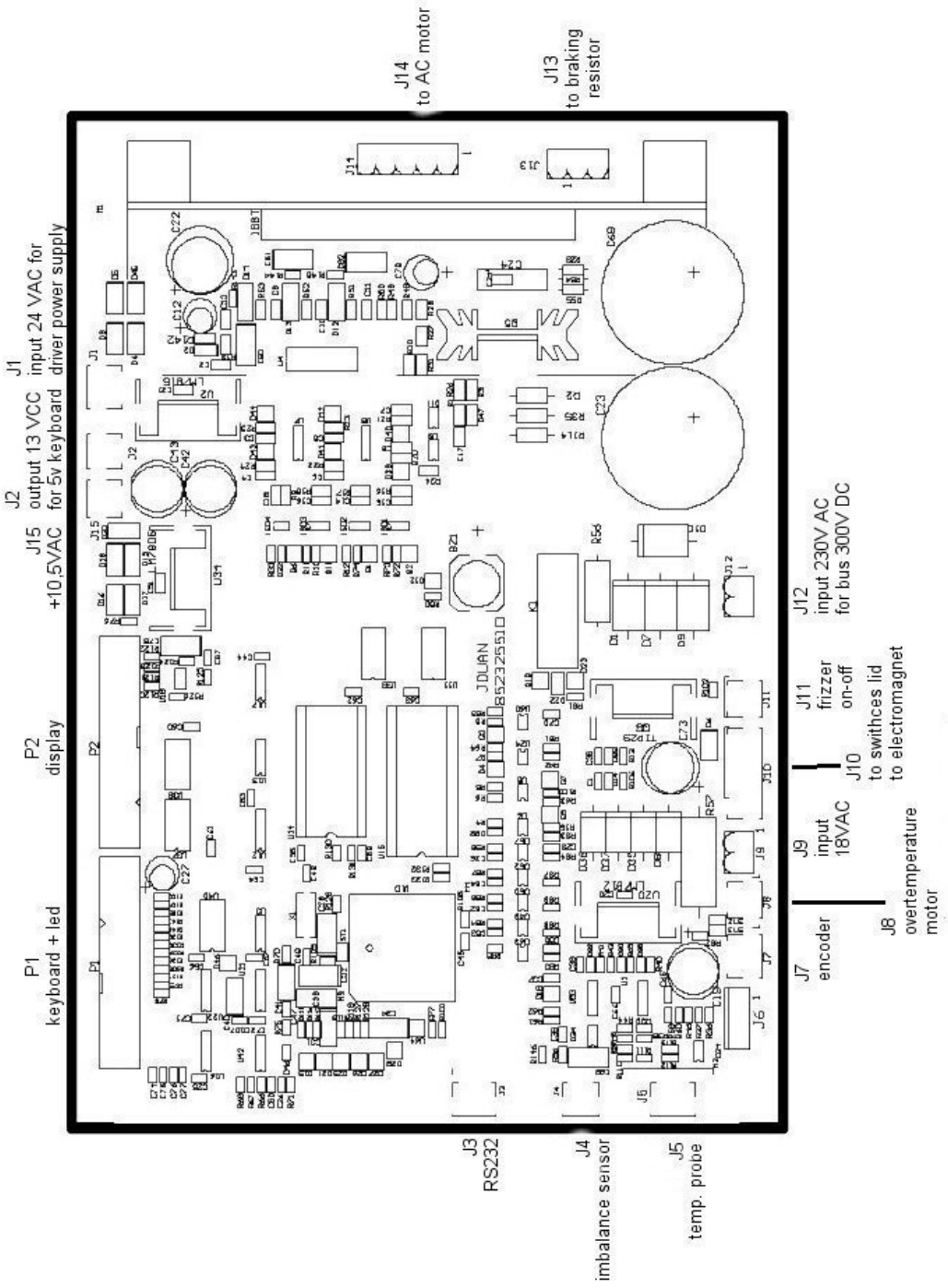


Fig. 9

120V version

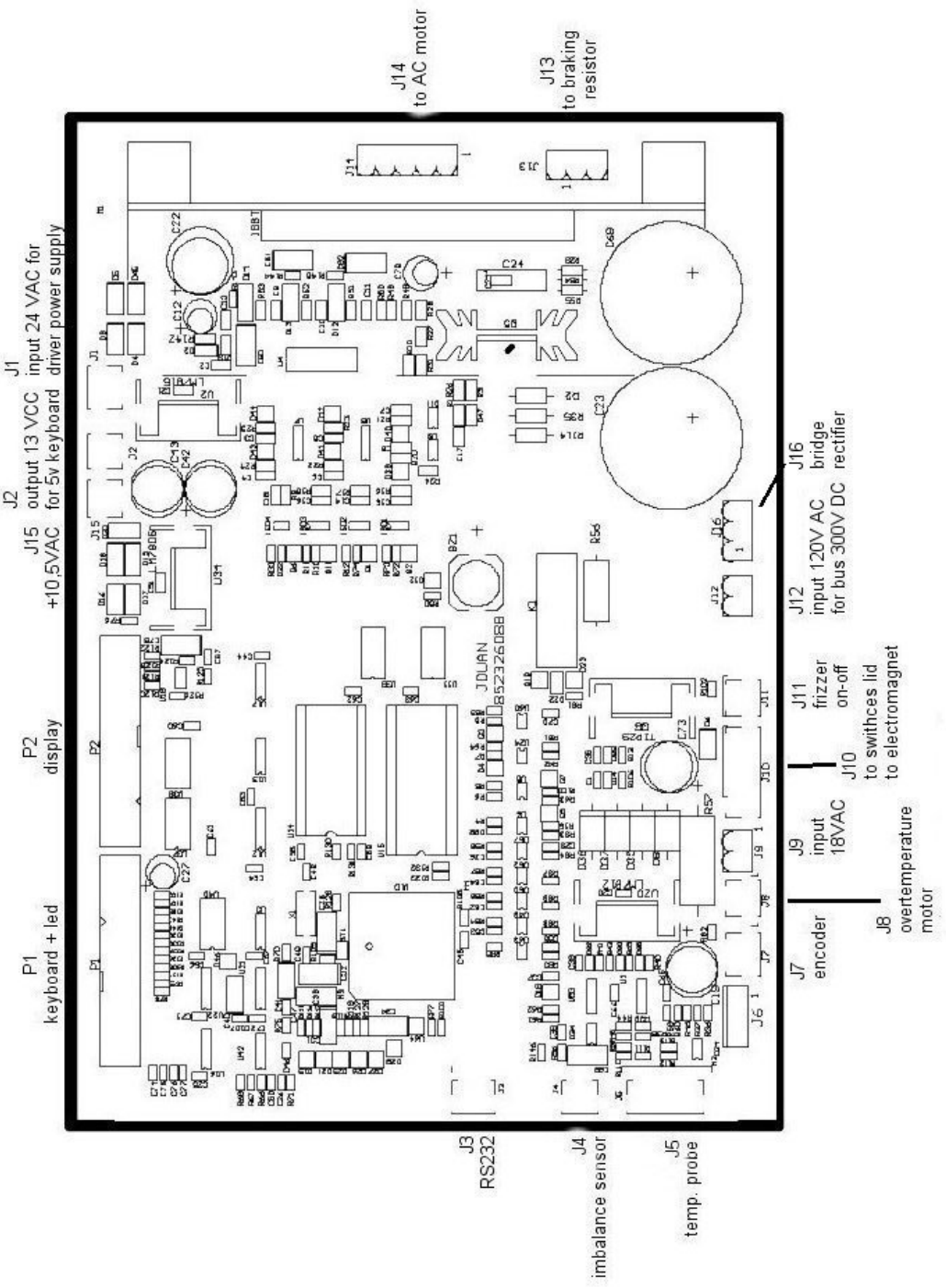


Fig. 10

4 DIAGNOSTICS AND REPAIRS

4.1 Introduction

The C3i centrifuge has some built-in functional tests which facilitate checks such as for the tachometer generator and lid lock solenoid.
In case of anomaly the display shows error codes combined with an audible alarm.

4.2 Messages

At power on:
- The *"TIME" display* shows the CENTRIFUGE MODEL (C3i)
- The *"SPEED" display* lights all the segments (88888).
- The *"TEMPERATURE" display* shows the PROGARM -EPROM REVISION (A, B, C….).

4.3 Error codes and messages

When a problem is detected an error code (combined with audible alarm) is displayed. According to the severity of the anomaly the run can be aborted, in this case the centrifuge stops automatically. For the details refer to the following table:

CODES	REASON	COMMENTS/EXIT
E 01	**Speed = zero** During rotation the speed has been suddenly measured zero	The information from tachometer is considered unreliable. The cycle stops without braking.
E 02	**Speed error.** Values of successive speed measurements are too different	The information from tachometer is considered unreliable. The cycle stops without braking.
E 03	--	--
E 04	**Rotor is spinning.** At power on the motor has been found in rotation.	The lid can be open when rotor speed is zero. Press any key to clean the message.
E 05	--	--
E 06	**Lid unlocked** during a run	Run stops. Operations are not allowed until the motor speed is zero. Press any key to clear the message
E 07	--	--
E 08	**Motor over-temperature** (above 130°C) **Solenoid error (reed relay)**	The run is interrupted. It is not possible to restart until the error condition is removed. Note: wait for motor cooling down.
LID	**Lid unlocked**. At centrifugation start the lid has been found open or unlocked	It is impossible to START. Close the lid or check if the lid is properly locked, the message will be automatically cleared
IMBAL	**Imbalance** detected	Run stops. Operations are not allowed until the motor is stopped. Press any key to clear the message. Check the rotor load.
____	**Programmed speed is wrong** The programmed speed is over the maximum speed allowed for the rotor in use	**Speed digits are blinking + audible alarm** Speed limit are at: 4.100 rpm or 10.000 rpm or 14600 rpm

5 REPLACEMENTS PROCEDURES

CAUTION: BEFORE ANY REPLACEMENT PROCEDURES DISCONNECT THE MAINS, REMOVING THE POWER CORD FROM THE CENTRIFUGE **!**

5.1 Front panel removal

Removal of the control panel allows access to many internal components. Follow this procedure to remove the front control panel:

1. Unplug the unit
2. Remove the 5 screws from the top and bottom edge of the front panel ②
3. Disconnect the wire harnesses:

- the mains switch wires
- the Flat Cables
- the display power supply cable
- the protective earth wire.

The two Flat Cables can be disconnected either from the μP+PWR side (connectors P1 and P2) or from the front panel: it is better to disconnect all of them from the same side to avoid errors during refitting. Disconnect the display power supply cable (red-black) from the front panel.

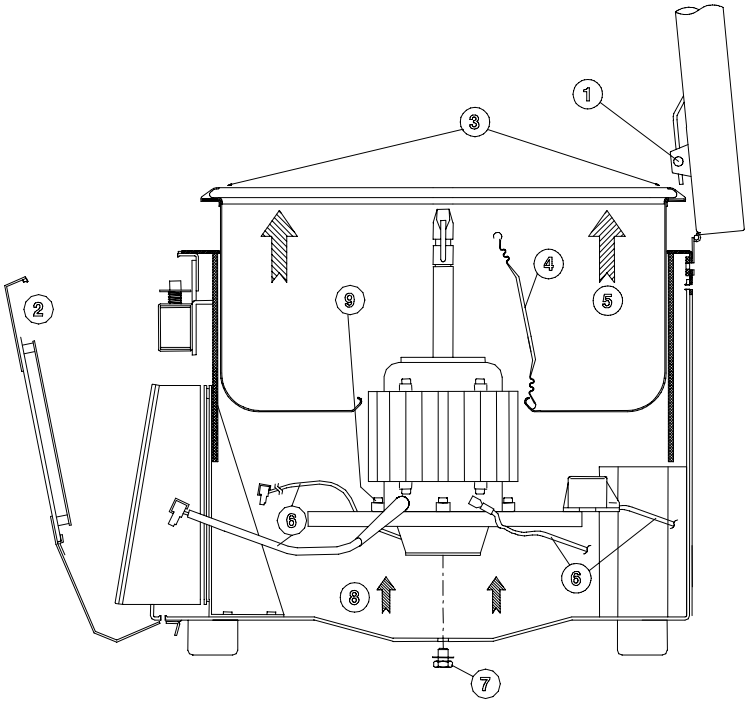


Fig. 11

5.2 Lid replacement (see Fig. 11)

1. Open the lid
2. Remove the spring pin from the gas spring ①
3. Unscrew the five screws connecting the lid to the lid hinge
4. Remove the lid.
5. Replace the lid in the same fashion, reversing the steps

FIXING SCREWS MUST BE CONSIDERED AS A COMPONENTS OF MECHANICAL SAFETY. CHECK CAREFULLY THAT THEY HAVE BEEN STRONGLY TIGHTENED !

5.3 Centrifuge bowl removal (see Fig. 11)

1. Remove the spring pin from the gas spring ①
2. Remove the bowl gasket ③ and unscrew the 3 screws from the centrifugation chamber top.
3. Remove the bowl-motor gasket ④.
4. Remove lifting-up the centrifugation bowl ⑤.

5.4 Imbalance sensor replacement (see Fig. 12)

1. Remove the bowl (see paragraph 5.3)
2. The detector is located on the motor counterweight
3. Unscrew the 2 screws and remove the sensor
4. Unplug the wire harness from the μP+PWR board, J4
5. Replace the sensor in the same fashion, reversing the steps
6. **Perform the sensor calibration** (see par 6.2)

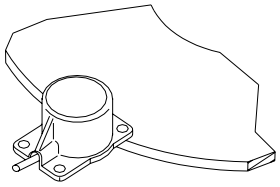


Fig. 12

5.5 Motor replacement (see Fig. 11)

1. Remove the front panel ② (see par. 5.1)
2. Remove the μP+PWR board
3. Remove the spring pin from the gas spring ①
4. Remove the bowl gasket ③ and unscrew the 3 screws from the centrifugation chamber top.
5. Remove the bowl-motor gasket ④.
6. Remove lifting-up the centrifugation bowl ⑤.
7. Disconnect the motor wire harnesses ⑥:
   - Encoder (J7, μP+PWR board),
   - Imbalance sensor (J4 , μP+PWR board)
   - Temperature sensor (J8 , μP+PWR board)
   - Motor windings (from the contactor)
8. Unscrew the motor fixing screw ⑦ located on the centrifuge basement plate
9. Unscrew the 4 screws (Allen key, number 4) to separate the motor from the counterweight .
10. Lift the motor up ⑧
11. Replace the motor in the same fashion, reversing the steps.

Check jumpers ST2 and ST3 (on μP+PWR board), as described in par 3.8.3
Check the rotation direction of the motor. IT MUST BE COUNTERCLOCKWISE

5.6 Speed sensor and shock absorbers replacement (see fig.13)

1. Remove the bottom flange ① unscrewing the 5 Phillips screws ②
2. Remove the encoder disk ⑥ unscrewing the screw ④ and the elastic washer ⑤
3. Remove the Hall effect sensor removing the 3 screws (10,11,12)
4. Unscrew the 5 shock absorbers ③
5. Remove the flange ⑦ unscrewing the 3 screws ⑧
6. Replace the flange and the shock absorbers reversing the steps
7. Replace the sensor reversing the steps
8. Replace the encoder disk reversing the steps

Screws ② ④ ⑧ (10) must glued using "Loctite 243"

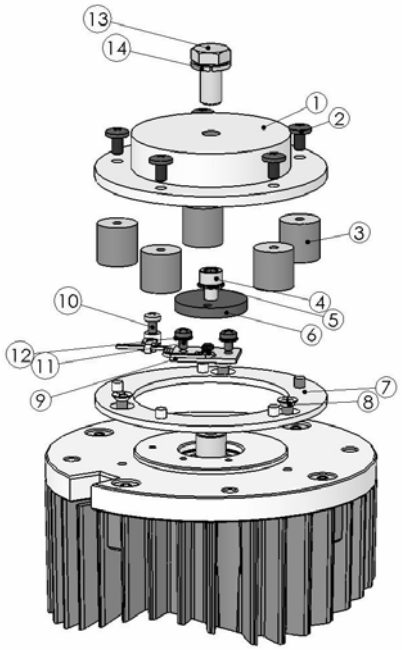


Fig. 13

5.7 Lid latch assembly

The latch assembly consists of the handle, two latches, 2 switches, a linkage, a locking solenoid and a reed relay. The cover strikers engages the latches, and when the latch is locked in the closed position disengage the two switches. The solenoid when is not activated locks the linkage movement. The switch senses the status of the cover (open, closed), the reed relay senses if the handle (and the linkage) is locked.

5.8 Replacement of the lid latch assembly

1. Open the lid.
   - Remove the front panel unscrewing the five screws (see Fig. 11) and disconnect:
   - the mains switch wires
   - the Flat Cables
   - the display power supply cable
   - the protective earth wire.
2. Disconnect the lid latches assembly from the μP+PWR board (J10).
3. Unscrew the four Phillips screws ①.
4. Remove the lid lock mechanism support
5. Reassemble (reversing the steps) with the new lid latch ensuring the alignment to get the proper latching

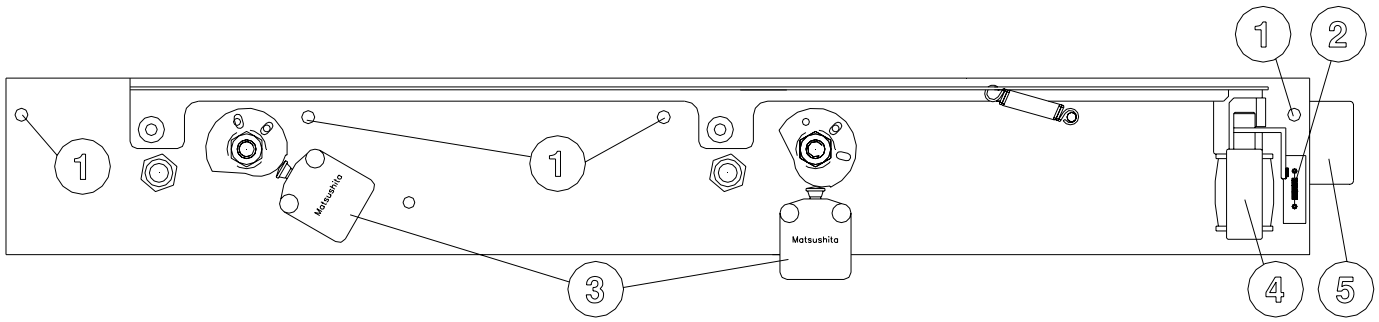


Fig. 14

① Fixing Phillips screws
② Solenoid micro-switch
③ Lid micro-switches
④ Solenoid
⑤ Lid handle

5.9 Replacement of lid latch spare parts

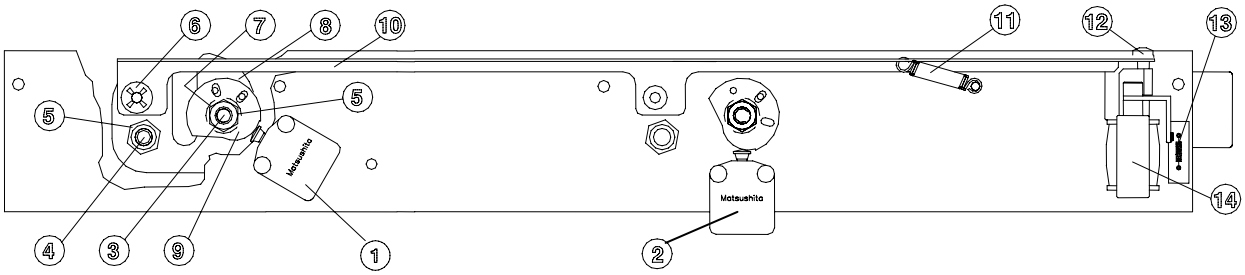


Fig. 15

5.9.1 Micro-switches replacement ① & ②

1. Disconnect the Fast-on connectors
2. Remove the two screws that secure the switch in place ②
3. Reposition the new switch securing it with the screws
4. Connect the Fast-on connectors
5. Test the lid latch (use a multimeter to measure resistance across the switch leads)
   - Switch ① should read open, when the cover is open (closed, when the cover is closed)
   - Switch ② should read open, when the cover is open (closed, when the cover is closed)
   - The reed relay should read closed when the solenoid is activated

5.9.2 Latch replacement

1. Remove the lid latch assembly as described in par 5.7
2. Extract the Quicklock Benzing ⑥.
3. Unscrew the nut ⑤.
4. Extract the screw ④
5. Unscrew the nut ⑨.
6. Remove the cam ⑧
7. Unscrew the nut underneath the cam
8. Extract the screw ③
9. Remove the latch
10. Replace the latch in the same fashion, reversing the steps

5.9.3 Reed relay (13)

1. Remove the two plastic screws
2. Unsolder the wire harness
3. Replace the sensor reversing the steps
4. Test the reed relay (use a multimeter to measure resistance across the sensor)
   - The reed relay should read open when lid is open (and the unit is not powered)
   - The reed relay should read closed when the solenoid is activated (during centrifugation)

5.9.4 Solenoid (14)

1. Remove the lid latch assembly as described in 5.7
2. Disconnect, cutting, the wiring to the solenoid
3. Unscrew the two fixing screws (latches side)
4. Slide the locking plunger out
5. Replace the new solenoid reversing the steps
6. Verify that the locking plunger is moving freely

5.10 Electronic rack and Mains front-end rack removal (see Fig. 16)

On the Electronic rack are located the μP+PWR board, the motor contactor, and the brake resistor (behind the μP board). Remove the μP board to access the brake resistor.
On the mains front-end rack are located the mains inlet socket with fuses, the line filter, the terminal block and the mains transformer. To replace one of those components the rack must be removed.

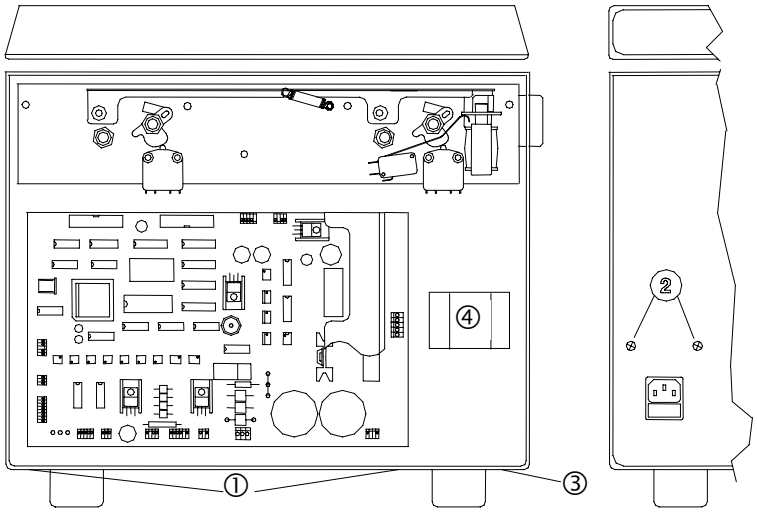


Fig. 16

1. Remove the front panel (see par 5.1)
2. Disconnect the wire harness to the contactor ④
3. Disconnect all cable μP+PWR board and the protective earth wire
4. Remove the electronic rack unscrewing the 4 screws ① located on the bottom of the centrifuge
5. Unscrew the Mains front-end rack (2 screws ② on the rear panel and 2 screws ③ located on the bottom of the centrifuge)
6. Slide out the Mains front-end rack

5.11 Gas spring replacement

1. Remove the front panel (see par 5.1)
2. Remove the centrifuge bowl (see par 5.3)
3. Remove the Electronic rack (see par 5.10)
4. Remove the Mains front-end rack (see par 5.10)
5. Remove the gas spring unscrewing the bolt located inside the centrifuge underneath the protective ring
6. Replace the gas spring reversing the steps

5.12 Micro Processor + PWR board replacement

1. Remove the front panel (see par 5.1)
2. Disconnect all cables and wire harnesses from the board:
3. Remove the board unscrew the 5 nuts.
4. Replace the board reversing the steps

⚠ Don' t forget the plastic insulation foil (Mylar®) between the chassis and the board.

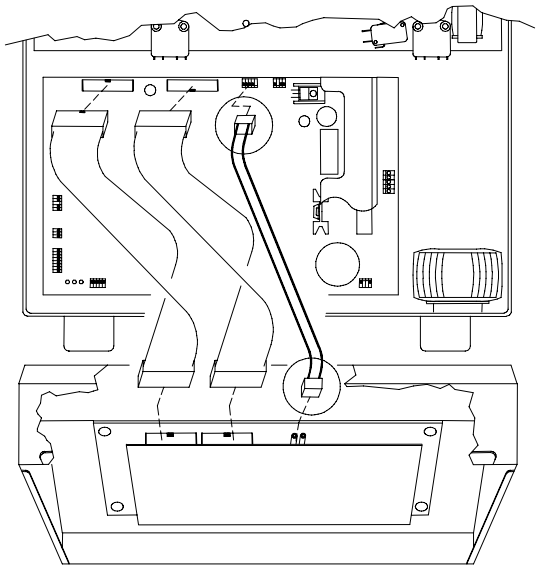
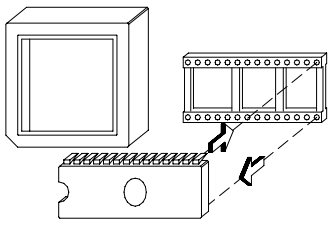


Fig. 17

5.13 EPROM replacement

It is not required to remove the P+PWR board for the EPROM replacement

⚠ **ATTENTION** **STATIC SENSITIVE.**
Proper handling and grounding precaution required



FOR EPROM REPLACEMENT USE ONLY THE SUITABLE EXTRACTOR !

DURING REPLACEMENT OPERATION KEEP THE EPROM PARALLEL TO THE SOCKET

INSERT THE NEW EPROM KEEPING THE KEY (SLOT) TOWARDS THE MICROPROCESSOR, ALWAYS USING THE EXTRACTOR

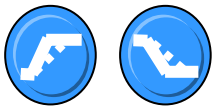
1. Unplug the unit
2. Remove the front panel (see par 4.1)
3. Replace the EPROM
4. **Perform the Memory Reset and the Imbalance calibration as described in par. 6**

6 DIAGNOSTIC AND CALIBRATION PROGRAM

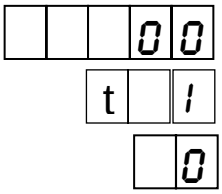
The centrifuge has a built-in diagnostic program which can be accessed by pressing a combination of buttons at power on.

6.1 Access to the Diagnostic Menu

1. At power-on, while the buzzer is activated press simultaneously the buttons *"acceleration"* and *"deceleration"* ramps



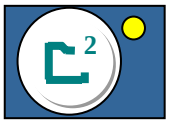
2. The display will show



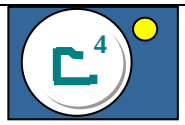
3. **Memory Reset**
   Keep pressed simultaneously (3 sec) the buttons "Pulse" and ▲. The default imbalance level, **350**, is loaded

⚠ After a memory reset is mandatory to proceed with the imbalance calibration

4. **Solenoid test**
   Pressing the button "user's program 2" the solenoid will be powered



5. **User's programs reset**
   Pressing the button "user's program 4" the User's programs will be cleared

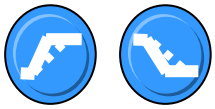


6. **Imbalance calibration menu**
   Press the "Start" button to access the **Imbalance calibration menu**

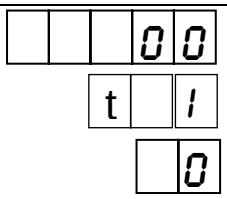
7. **Exit from Diagnostic and calibration Program**
   Press the button "Stop" to exit from

6.2 Imbalance Calibration

1. At power-on, while the buzzer is activated, press simultaneously the buttons *"acceleration"* and *"deceleration"*

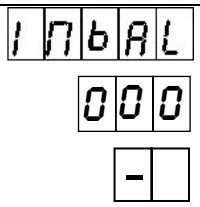


2. The display will show



3. **Second menu**
   Press the "Start" button to access the **Imbalance calibration menu**

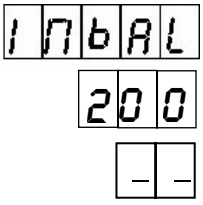
4. The display will show



5. Install the rotor **T40 (unloaded)** and press the "Pulse" button. The first calibration cycle **(2500rpm, 50 sec)** will start.

The rotor must be balanced. The difference in weight between buckets should be maximum ±0,5 grams

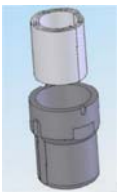
6. At the end of the run the imbalance level measured is displayed.



For a balanced rotor the value detected shall be < 200

If the value is > 200 and the rotor is balanced the sensor could be defective

7. Load bucket n° 1 with the calibrated weight (17 grams-Mylar)
8. Press the pulse button, whe secon calibration cycle will start (2500rpm, 50 sec).
   At the end of the run the imbalance level detected will be displayed.



The imbalance level must be between 300 and 700

9. **Exit from Diagnostic and calibration Program**
   Press the button "Stop" to exit from

7 MOTOR VERIFICATIONS

7.1 Motor checking

Simple electrical tests suggested to verify the status of the motor, (use a multimeter to measure resistance across the motor windings).

Check :

1. Electrical continuity between all the two phases combinations.
   In case of open circuit the motor will not run

2. Resistance of two phases values must be 7Ω ± 20%

3. The difference between two phases should not differ more than ± 0.2Ω);
   If not the motor doesn't run smoothly (jerks)

7.2 Centering device assembly

Verify:

1. the correct washers sequence

2. the free movements of the washers

3. the washers must be properly greased.

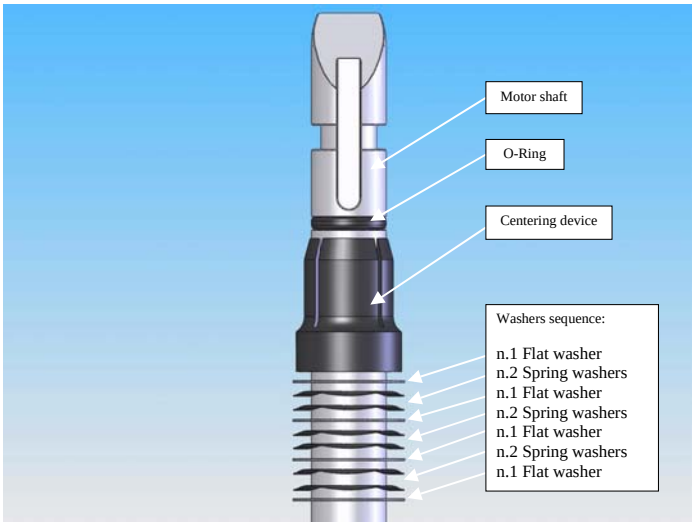


Fig. 18

8.1 Centrifuge spare parts

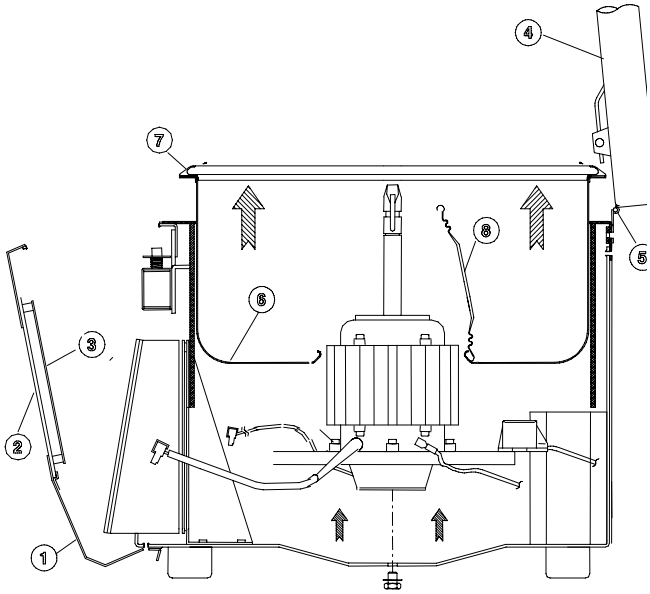


Fig. 19

Reference	CAT n.	DESCRIPTION	Qty.
	25535010	Tool to open the unit without power	1
	11202979	Tool to remove the rotor	1
	85480453	Magnetic plate	1
	86000692	Drain Tube	1
	86003202	Cap for drain tube	1
	86005398	*Grease for buckets*	1
See			
Fig 19 - ①	89000838	*Mains switch*	1
Fig 19 - ②	39902496	Keypad membrane	1
Fig 19 - ③	89002890	*Display board*	1
Fig 19 - ④	11250200	*Lid Assy*	1
	85240195	*Latch strike (hook)*	1 of 2
Fig 19 - ⑤	11200717	*Lid hinge*	1
	26962012	*Gas spring*	1
Fig 19 - ⑥	89002039	*Centrifugation bowl chamber*	1
Fig 19 - ⑦	89000943	*Bowl gasket*	1
Fig 19 - ⑧	89000839	*Bowl-Motor gasket*	1
	11200593	*Centrifuge feet*	4
	11201653	*Inner plastic part of the lid*	1

8.2 Electronic rack spare parts

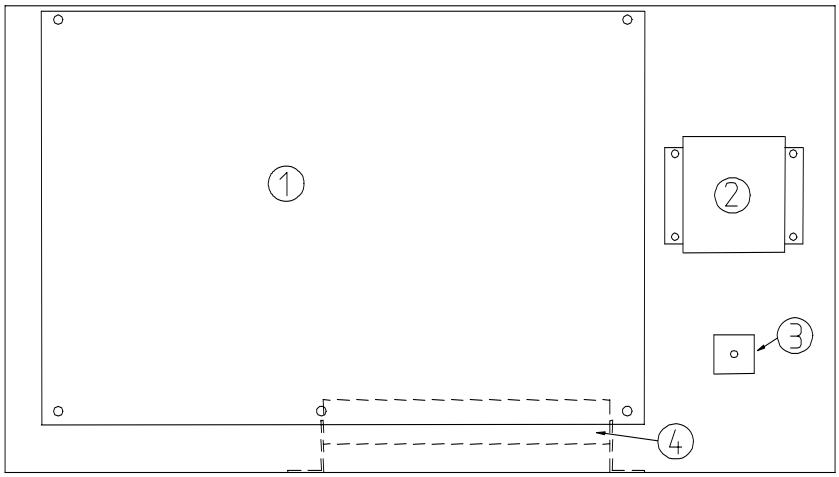


Fig. 20

See Fig. 20			
① + ② + ③ + ④	**85481424**	***Electronic rack (kit of components 230V)***	1
Fig 20 - ①	89003436*	μP+PWR board (230V) NEW MOTOR – (tested) for Sn > 305100385	1
Fig. 20 - ①	89003463*	μP+PWR board (230V) OLD MOTOR – (tested) for Sn < 305100385	
Fig 20 - ②	86004585	*Contactor (230V)*	1
Fig 20 - ④	86001432	*Brake resistor*	1
① + ② + ③ + ④	**85481425**	***Electronic rack (kit of components 100- 120V)***	1
Fig 20 - ①	89003437*	μP+PWR board (120V) NEW MOTOR - (tested) for Sn > 305100385	1
Fig. 20- ①	89003462*	μP+PWR board (120V) OLD MOTOR - (tested) for Sn < 305100385	
Fig 20 - ③	86004598	*Bridge rectifier (120V)*	1
Fig 20 - ②	86004586	*Contactor ((120V)*	1
Fig 20 - ④	86001432	*Brake resistor*	1
	11250210	*EPROM programmed*	1

** doesn't contain eprom*

8.3 Motor spare parts

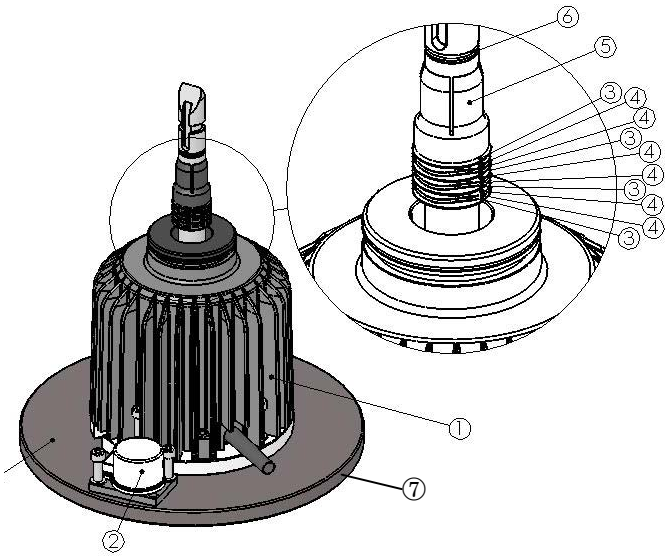


Fig. 21

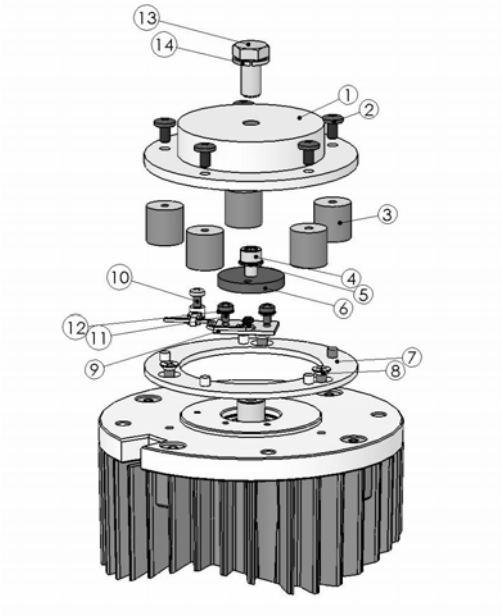


Fig. 22

Reference	CAT n.	DESCRIPTION	Qty.
See Fig. 21			
Fig. 21	11250202	***Motor assy***	1
Fig.21 - ③④⑤⑥	11250172	***Shaft accessory Kit***	
Fig.21 - ③		*Flat washer (thickness 0.5)*	4
Fig.21 - ④		*Spring washer*	6
Fig.21 - ⑤		*Plastic Centering device*	1
Fig.21 - ⑥		*O-Ring*	1
Fig.21 - ②	39902739	*Imbalance detector*	1
Fig.21 - ⑦	11200508	*Motor Counterweight*	1
	86005398	*Grease*	1
See Fig. 22			
Fig.22	11250204	***Shock Absorbers kit***	1
Fig.22 - ①		*Shock absorbers bottom flange*	1
Fig.22 - ③		*Shock absorbers Ø15x15 f-f 55ShA*	5
Fig.22 - ⑥		*Magnetic disk assy*	1
Fig.22 - ⑦		*Shock absorbers upper flange*	1
Fig.22 - ⑨		*Hall effect sensor kit*	1
-		*Set of screws*	-
		Grease	1
Fig.22 - ③	11250203	*Shock absorbers Ø15x15 f-f 55ShA (set of 5)*	1
Fig.22 - ⑨	11250212	*Hall effect sensor kit*	1

8.4 Lid latch spare parts

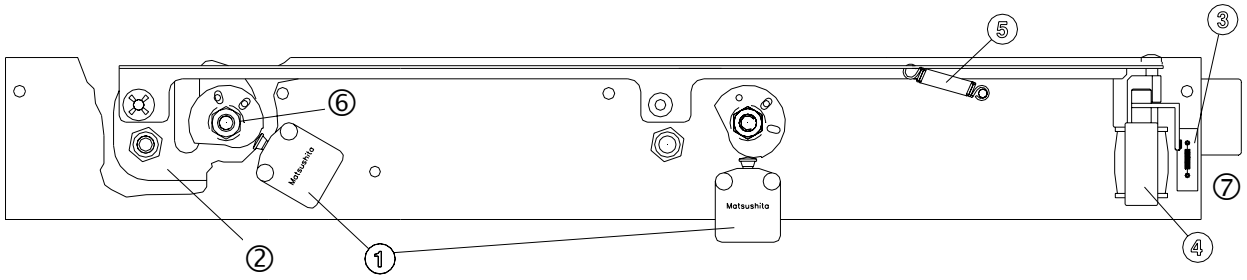


Fig. 23

Reference	CAT n.	DESCRIPTION	Qty.
Fig. 23	**85481432**	***Lid Latch assy***	1
Fig. 23 - ①	86001406	*Lid micro-switch*	1
Fig. 23 - ②	11201185	Latch	2
Fig. 23 - ③	39900043	*Solenoid switch (Reed Relay)*	1
Fig. 23 - ④	85140275	*Solenoid*	1
Fig. 23 - ④	85440187	Solenoid Spring	1
Fig. 23 - ⑤	11250207	*Spring*	1
Fig. 23 - ⑥	11201156	Locking cam	2
Fig. 23 - ⑦	85440203	Handle	1

8.5 Mains front-end spare parts

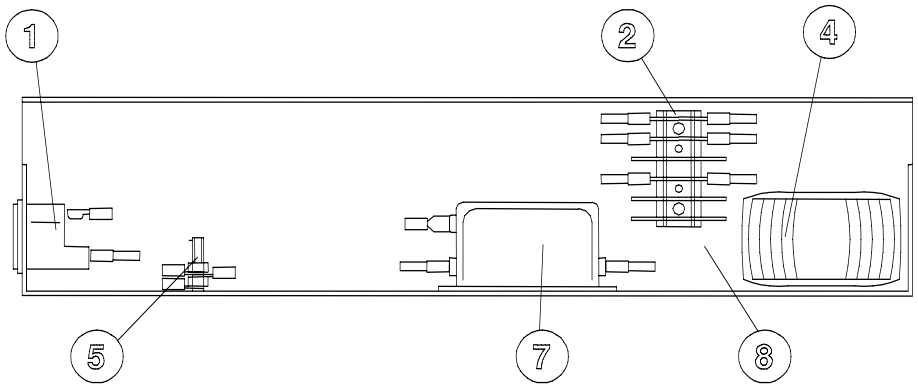


Fig. 24

Reference	CAT n.	DESCRIPTION	Qty.
① + ④ + ⑦	**39902981**	**Mains front-end rack (kit of components 230V)**	1
Fig. 24 - ④	86004803	*Toroidal transformer 230Volt*	1
Fig. 24 - ⑦	86003248	*Line filter 230Volt*	1
Fig. 24 - ①	86000775	*Mains inlet and fuse holder*	1
① + ④ + ⑦	**39902587**	***Mains front-end rack* (kit of components 120V)**	1
Fig. 24 - ④	39903078	*Toroidal transformer 120Volt*	1
Fig. 24 - ⑦	86003256	*Line filter 120Volt*	1
Fig. 24 - ①	86000775	*Mains inlet and fuse holder*	1

8.6 Transformers for 100V version

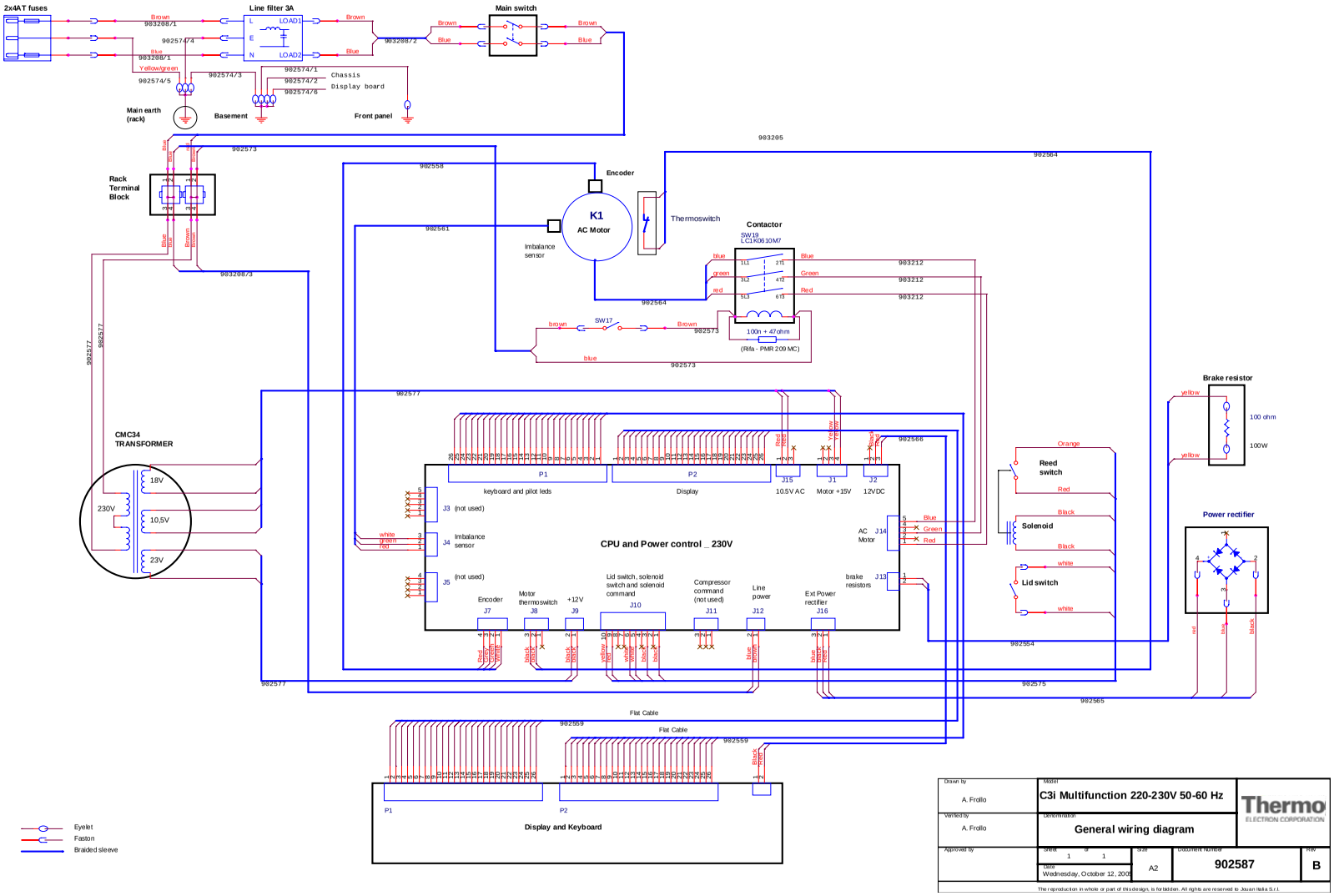
Reference	CAT n.	DESCRIPTION	Qty.
	11250205	*Transformer 100V 50-60Hz*	1

8.7 Rotors and Accessories

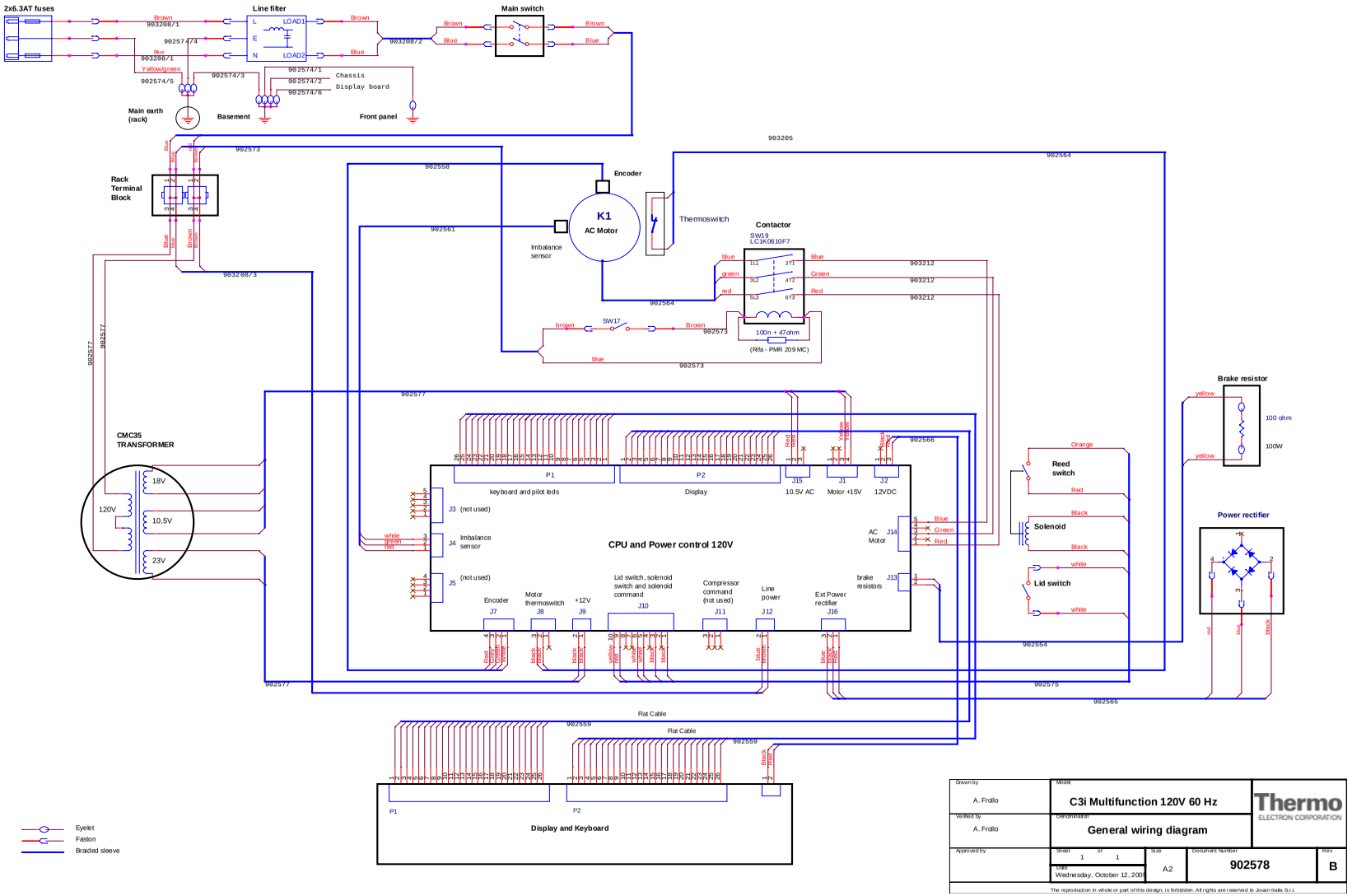
Reference	CAT n.	DESCRIPTION	Qty.
	11175710	T40 Swing-Out Rotor	1
	11210246	S41 Swing-Out Rotor (4x200ml)	1
	11175750	T20 Microtiter Plate Rotor for 2 x 3 Plates, 1157xg	1
	11175755	AC15.4 Angle Rotor, 30 x 15ml (17.5x100mm)	1
	11175756	AC100.10 Angle Rotor, 6 x 100ml (38x101mm)	1
	11175754	AC50.10 Angle Rotor, 6 x 50ml	1
	11175737	AC10.12 Sealed Angle Rotor, 10 x 10ml (16x80mm)	1
	11175739	AC1.14 Angle Rotor, 20x1.5-2ml (11x39mm)	1
	11175741	AC2.14 Sealed Angle Rotor, 24 x 1.5-2ml (11x39mm)	1
	11175743	DC6.11 Drum Rotor, 6 Micro tubes Racks	1
	11210351	AC2.13, Sealed FiberLite Angle Rotor, 48 x 1.5ml	1

9 APPENDIX 1

9.1 Wiring diagram 230 V version 50-60Hz



9.2 Wiring diagram 120V version 60Hz



9.3 Wiring diagram 100V version 50-60Hz